

NASA TECH BRIEF

NASA Pasadena Office



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Rubber Compositions Compatible with Hydrazine

The problem:

To improve the compatibility of butyl rubbers with hydrazine and to reduce permeation to the low levels necessary for prolonged storage in space.

The solution:

Replace carbon-black filler with inert materials such as hydrated silica or clay.

How it's done:

The following formulation provides a rubber composition suitable for hydrazine service:

| | |
|--------------------------------|-----------|
| Butyl rubber | 100 parts |
| Precipitated hydrated silica | 65 parts |
| Zinc oxide | 5 parts |
| Sulfur | 1.5 parts |
| Tetramethylthiuram monosulfide | 1.5 parts |
| 2-Mercaptobenzothiazole | 0.5 part |

The rubber is put into a Banbury mixer and half of the total amount of fillers is added during the next 30 seconds; then the remainder of the fillers are incorporated into the mass over a 2-minute interval. After a 5-minute period of mastication, the mass is removed and placed on a mill. The vulcanizing agents are added and the whole is blended thoroughly over a 5-minute period. Thin sheets, about 1.02 mm (0.04 in) thick are milled and placed in molds at 121°C (250°F); mold pressure is raised to the desired level in seven equal steps at one-minute intervals. Pressure is maintained at the maximum level for at least 15 minutes or until the stock ceases to flow. The temperature is raised to 166°C (310°F) and held for 30 minutes; the mold is cooled to 93°C (200°F) while

maximum pressure is maintained, and then the mold is opened slowly. The physical properties of the resulting rubber are:

| | |
|-------------------|------------------------------------|
| Tensile strength | 12.41 MN/m ² (1800 psi) |
| Elongation | 610% |
| 200% Modulus | 2.93 MN/m ² (425 psi) |
| Hardness, Shore A | 67 |

The compression set of the rubber is 27.6% after 7 days at 73°C (158°F).

Typically, the rubber composition shows the first measurable permeation of hydrazine after 590 hours [for section thicknesses of 1.32 to 1.70 mm (0.052 to 0.067 in)] and a permeation rate of the order of 0.003 mg/cm² (0.022 mg/in²) after about 760 hours. In closed vessel tests, observed pressure increases suggest that hydrazine is decomposed only slightly by the new type of rubber.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
Pasadena, California 91103
Reference: TSP 73-10019

Patent status:

NASA has decided not to apply for a patent.

Source: John Repar of
Accessory Products Company
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